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(54) **METHOD OF CLEANING A VIA HOLE**

(57) In a method of manufacturing a semiconductor device having a multi-layer interconnection, after a via hole has been formed, the inside of the via hole is cleaned using a cleaning solution containing a complexing agent capable of forming a complex with contaminants of copper type metals.

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# EUROPEAN SEARCH REPORT

Application Number  
EP 99 11 9623

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IntCl.7)
Y	EP 0 678 571 A (BAKER J T INC) 25 October 1995 (1995-10-25) * page 1, line 1 - page 4, line 6 * * page 10, line 40 - page 11, line 46 * ---	1,2,4,5, 10	H01L21/3105
Y	US 5 354 712 A (HO YU Q ET AL) 11 October 1994 (1994-10-11) * column 5, line 53 - column 7, line 45; figures 1A-1G * ---	1,2,4,5, 10	
A	US 5 451 551 A (KRISHNAN AJAY ET AL) 19 September 1995 (1995-09-19) -----		
			TECHNICAL FIELDS SEARCHED (Int.Cl.7)
			H01L
<p>The present search report has been drawn up for all claims</p>			
Place of search		Date of completion of the search	Examiner
MUNICH		10 December 1999	Boetticher, H
<p>CATEGORY OF CITED DOCUMENTS</p> <p>X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document</p> <p>T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons ..... &amp; : member of the same patent family, corresponding document</p>			

EPO FORM 1503 03 82 (P04C01)



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**CLAIMS INCURRING FEES**

The present European patent application comprised at the time of filing more than ten claims.

- ☐ Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims and for those claims for which claims fees have been paid, namely claim(s):
- ☐ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims.

**LACK OF UNITY OF INVENTION**

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

see sheet B

- ☒ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.
- ☐ As all searchable claims could be searched without effort justifying an additional fee, the Search Division did not invite payment of any additional fee.
- ☐ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid, namely claims:
- ☐ None of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:



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LACK OF UNITY OF INVENTION  
SHEET B

Application Number

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The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

1. Claims: 1,2,4,5,10

A via hole dry etched through an insulating film to a copper containing wiring is cleaned from metallic contaminants by a cleaning solution containing a complexing agent such as a polyaminocarboxylic acid like EDTA or a carboxylic acid like citric acid.

This is obvious from EP-A-0 678 571 page 3 last paragraph and Example 6.

2. Claim : 3

The complexing agent contains a polyaminocarboxylic acid and a carboxylic acid.

3. Claim : 6

The insulating film is an SOG film.

4. Claim : 7

The insulating film is an HSQ film.

5. Claim : 8

After dry etching and before cleaning a solution containing an amine compound is applied to the via hole.

6. Claim : 9

The cleaning solution further contains an amine compound.

**ANNEX TO THE EUROPEAN SEARCH REPORT  
ON EUROPEAN PATENT APPLICATION NO.**

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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.  
The members are as contained in the European Patent Office EDP file on  
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10-12-1999

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

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